NACA

RESEARCH MEMORANDUM

EXPLORATORY INVESTIGATION AT MACH NUMBER 4.06

OF AN AIRPLANE CONFIGURATION HAVING

A WING OF TRAPEZOIDAL PLAN FORM

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS

By Robert W. Dunning and Edward F. Ulmann

Langley Aeronautical Laboratory
Langley Field, Va.

NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS
WASHINGTON

April 28, 1955
Declassified September 1, 1961

NACA RM L55B28

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

RESEARCH MEMORANDUM

EXPLORATORY INVESTIGATION AT MACH NUMBER 4.06

OF AN AIRPLANE CONFIGURATION HAVING

A WING OF TRAPEZOIDAL PLAN FORM

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS

By Robert W. Dunning and Edward F. Ulmann

SUMMARY

An investigation to determine the longitudinal and lateral control characteristics of an airplane configuration having a trapezoidal wing with modified hexagonal airfoil section and a cruciform tail with 5° semi-angle wedge section has been carried out in the Langley 9- by 9-inch Mach number 4 blowdown jet. Tests on the complete model and on the model with either the upper or lower vertical tail removed were made at a Mach number of 4.06 and a Reynolds number of 2.7×10^6, based on wing mean aerodynamic chord. Data were obtained for angles of attack from 0° up to 12° at angles of sideslip from 0° up to 8°. The incidence angles of the all-movable tails were varied from 6° to -8°, which permitted obtaining effective downwash angle as well as control effectiveness. The data are presented with respect to the body axes.

INTRODUCTION

The aircraft configurations previously investigated experimentally at high supersonic and hypersonic speeds have been restricted to missile types which were not required to land, and which therefore had relatively small wings or wings of very low aspect ratio. The purpose of the present investigation was to determine the characteristics of a configuration conforming more closely to a piloted aircraft having a wing area sufficient for conventional landing. Of the various possible configurations, one was selected for this exploratory study which was expected to have satisfactory low-speed characteristics and satisfactory transonic characteristics. This configuration (fig. 1) employs a trapezoidal wing and the arrangement, in general, is similar to conventional airplanes. Two particular features were incorporated which are believed to be desirable

for high supersonic and hypersonic operation - relatively large leading-edge radii for both wing and tails, and wedge-shaped sections for the tails. The wing and tail sections were designed with large leading-edge radii because of heat-transfer considerations at high Mach numbers. The wing leading-edge radius, for example, would be approximately 1.5 inches at the wing-fuselage intersection for a full-size airplane having a wing span of about 28 feet. Inasmuch as the effectiveness of lifting surfaces having flat-plate or conventional supersonic airfoil sections decreases considerably with Mach number at high supersonic speeds (ref. 1), the effectiveness of tail surfaces of conventional size utilizing these air-foil sections would be marginal or insufficient at the Mach number of the present tests. Several types of tail airfoil sections therefore are being considered and the present results were obtained with a 5° semi-angle wedge section.

In references 2, 3, and 4, longitudinal and lateral stability data were presented for this airplane configuration and various combinations of its components at Mach numbers of 4.06 and 6.86. Reference 5 presents longitudinal and lateral control data at Mach number 6.86. This report presents the longitudinal and lateral control characteristics at Mach number 4.06 of the complete configuration and of the configuration with either the upper or lower vertical tail removed. The data have been analyzed only to the extent that effective downwash angle and some sta-bility determinants have been obtained.

<div align="center">SYMBOLS</div>

The results of the tests are presented as standard NACA coefficients of forces and moments. The data are referred to the body axes (fig. 2) with the reference center of gravity at 54 percent of the wing mean aero-dynamic chord (52.66 percent of the body length from the body nose).

C_N normal-force coefficient, $-Z_B/qS$

C_Y lateral-force coefficient, Y/qS

C_m pitching-moment coefficient about center of gravity, $M'/qS\bar{c}$

C_n yawing-moment coefficient about center of gravity, N/qSb

C_l rolling-moment coefficient, L/qSb

Z_B force along Z_B axis

Y force along Y-axis

M' moment about Y-axis

N moment about Z_B-axis

L moment about X_B-axis

q free-stream dynamic pressure

S total wing area, including area submerged in fuselage

c wing chord

$\bar{c}$ wing mean aerodynamic chord

c_t tail root chord

b wing span

R Reynolds number based on $\bar{c}$

M Mach number

α angle of attack of fuselage center line, deg

β angle of sideslip, deg

i_H angle of incidence of horizontal tail relative to fuselage center line, deg

i_V angle of incidence of vertical tail relative to fuselage center line, deg

ϵ effective angle of downwash, deg

C_{m_t} increment of pitching-moment coefficient provided by the tail

n_p neutral-point location, percent of body length

$\dfrac{\partial C_m}{\partial C_N}$ rate of change of pitching-moment coefficient with normal-force coefficient

$\dfrac{\partial C_m}{\partial i_H}$ rate of change of pitching-moment coefficient with horizontal-tail incidence angle

$\dfrac{\partial \epsilon}{\partial \alpha}$ rate of change of effective downwash angle with angle of attack

C_{Y_β} rate of change of lateral-force coefficient with angle of sideslip

C_{n_β} rate of change of yawing-moment coefficient with angle of sideslip

C_{l_β} rate of change of rolling-moment coefficient with angle of of sideslip

Model designations:

B   body

W   wing

T_H horizontal tail

T_{VU} upper vertical tail

T_{VL} lower vertical tail

APPARATUS

The tests were conducted in the Langley 9- by 9-inch Mach number 4 blowdown jet, which is described and for which a calibration is given in reference 6. The settling-chamber pressure, which was held constant by a pressure-regulating valve, and the corresponding air temperature were continuously recorded during each run. A sting-mounted internal strain-gage balance which measured normal force, pitching moment, side force, yawing moment, and rolling moment was used to obtain the data.

MODELS

The model configurations used for the present tests consisted of a complete model (figs. 1 and 3) and the model with either the upper or

lower vertical tail removed. Details concerning the geometric charac-
teristics of the model and the wing and tail sections are given in
table I and figures 3 and 4. The model designations used throughout
the report are graphically illustrated in figure 5. The wing has a
trapezoidal plan form with a hexagonal section that has been modified by
rounding the leading edge to a 1-percent-chord radius and blunting the
trailing edge to a 2-percent-chord thickness. The wing has a maximum
thickness of 4 percent, and the quarter chord is swept back 29°. The
tails have a trapezoidal plan form, 5° semiangle wedge section, and
0.007-inch leading-edge radius. The all-movable tails pivot about axes
through the $53\frac{1}{2}$ percent root-chord station of the tail (fig. 3). A
photograph of the complete airplane configuration installed in the
Langley 9- by 9-inch Mach number 4 blowdown jet is presented in figure 6.

TESTS

The settling-chamber stagnation temperature during any single run
varied from approximately 80° to 40° F, and the settling-chamber stagna-
tion pressure was held at approximately 186 lb/sq in. abs. These condi-
tions correspond approximately to a Reynolds number of 2.7×10^6, based
on the wing mean aerodynamic chord. The tests were run at humidities
below 5×10^{-6} pounds of water vapor per pound of dry air, which is
believed to be low enough to eliminate water-condensation effects. The
test-section static temperature and pressure did not reach the point
where liquefaction of air would take place. Data were obtained for angles
of attack from 0° up to 12° at angles of sideslip from 0° up to 8°. The
tail incidence angle was varied from 6° to -8°. The tests with varying
horizontal-tail incidence were made only at zero vertical-tail incidence
and the tests with varying vertical-tail incidence were made only at zero
horizontal-tail incidence.

PRECISION OF DATA

The probable uncertainties in the test data due to the accuracy
limitations of the balances and the recording equipment and the ability
of the system to repeat data points are listed in the table below. The
accuracy of the rolling-moment coefficients is low relative to the maxi-
mum rolling moment encountered. This is because rolling-moment gages
were added to an existing balance which was not originally designed to
measure rolling moment.

C_N . . . . ± 0.001

C_Y . . . . ± 0.0003

C_m . . . . ± 0.0004

C_n . . . . ± 0.00005

C_l . . . . ± 0.0009

α, deg . . . . ± 0.1

β, deg . . . . ± 0.1

RESULTS

The experimental longitudinal and lateral control characteristics of the configurations are given for all angles of attack and sideslip tested in table II, and representative portions of the data are presented in the figures. Equations for transferring these coefficients from the body axes to the stability axes are presented in the appendix.

The longitudinal control characteristics of the models are presented in figures 7 and 8. Trim longitudinal stability determinants and trim longitudinal characteristics for the complete model are presented in figures 9 to 11. The effective downwash angle was obtained by means of the relation

$$\epsilon = \alpha + i_H - \frac{C_{m_t}}{\partial C_m / \partial i_H}$$

The effects of sideslip angle on the lateral and longitudinal characteristics of the models are presented in figures 12 to 14. Figure 15 presents some lateral stability parameters. The variations of the lateral characteristics with normal-force coefficient are presented in figure 16, and in figure 17 the effect on the yawing-moment coefficient of varying the vertical tail incidence angle is presented.

Langley Aeronautical Laboratory,
    National Advisory Committee for Aeronautics,
        Langley Field, Va., February 16, 1955.

APPENDIX

The equations for the transfer of force and moment coefficients from the body-axis system to the stability-axis system are as follows:

$$C_{Y_S} = C_{Y_B}$$

$$C_{l_S} = C_{l_B} \cos \alpha + C_{n_B} \sin \alpha$$

$$C_{n_S} = C_{n_B} \cos \alpha - C_{l_B} \sin \alpha$$

$$C_{m_S} = C_{m_B}$$

Inasmuch as longitudinal forces were not measured, the axis-transfer equations for lift and drag coefficients are not given here.

REFERENCES

1. McLellan, Charles H.: A Method for Increasing the Effectiveness of
   Stabilizing Surfaces at High Supersonic Mach Numbers. NACA
   RM L54F21, 1954.

2. Dunning, Robert W., and Ulmann, Edward F.: Static Longitudinal and
   Lateral Stability Data From an Exploratory Investigation at Mach
   Number 4.06 of an Airplane Configuration Having a Wing of Trape-
   zoidal Plan Form. NACA RM L55A21, 1955.

3. Penland, Jim A., Ridyard, Herbert W., and Fetterman, David E., Jr.:
   Lift, Drag, and Static Longitudinal Stability Data From an Explor-
   atory Investigation at a Mach Number of 6.86 of an Airplane Config-
   uration Having a Wing of Trapezoidal Plan Form. NACA RM L54L03b,
   1955.

4. Ridyard, Herbert W., Fetterman, David E., Jr., and Penland, Jim A.:
   Static Lateral Stability Data From an Exploratory Investigation at
   a Mach Number of 6.86 of an Airplane Configuration Having a Wing of
   Trapezoidal Plan Form. NACA RM L55A21a, 1955.

5. Fetterman, David E., Jr., Penland, Jim A., and Ridyard, Herbert W.:
   Static Longitudinal and Lateral Stability and Control Data From
   an Exploratory Investigation at a Mach Number of 6.86 of an Air-
   plane Configuration Having a Wing of Trapezoidal Plan Form. NACA
   RM L55C04, 1955.

6. Ulmann, Edward F., and Lord, Douglas R.: An Investigation of Flow
   Characteristics at Mach Number 4.04 Over 6- and 9-Percent-Thick
   Symmetrical Circular-Arc Airfoils Having 30-Percent-Chord Trailing-
   Edge Flaps. NACA RM L51D30, 1951.

TABLE I.- GEOMETRIC CHARACTERISTICS OF COMPLETE MODEL

Wing:
    Area (including area submerged in fuselage), sq in. 6.24
    Span, in. 4.33
    Mean aerodynamic chord, in. 1.716
    Root chord, in. 2.53
    Tip chord, in. 0.354
    Airfoil section . . . . Hexagonal with round leading edge
    Taper ratio 0.140
    Aspect ratio 3.00
    Sweep of leading edge, deg 38.83
    Sweep of quarter-chord line, deg 29
    Incidence at fuselage center line, deg 0
    Dihedral, deg 0
    Geometric twist, deg 0

Horizontal and vertical tails:
    Area (including area submerged in fuselage), sq in. 2.06
    Span, in. 2.69
    Mean aerodynamic chord, in. 0.853
    Root chord, in. 1.214
    Tip chord, in. 0.317
    Airfoil section . . . . $5°$ semiangle wedge
    Taper ratio 0.261
    Aspect ratio 3.52
    Sweep of leading edge, deg 22.63
    Dihedral, deg 0

Fuselage:
    Length, in. 7.50
    Maximum diameter, in. 0.790
    Fineness ratio 9.50
    Base diameter, in. 0.790
    Distance from nose to moment reference 3.950
    Ogive nose length, in. 2.29
    Ogive radius, in. 6.85

TABLE II

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(a) $BWT_HT_{VU}T_{VL}$								
4	0	0	0	0.0115	−0.0219	−0.0007	−0.0001	0.0006
			1	.0162	−.0231	−.0117	.0025	.0012
			2	.0151	−.0231	−.0231	.0050	.0012
			3	.0142	−.0230	−.0344	.0075	.0009
			4	.0127	−.0228	−.0460	.0099	0
			5	.0129	−.0230	−.0573	.0122	−.0001
		2	0	.0599	−.0367	.0002	−.0002	.0006
			1	.0673	−.0389	−.0111	.0024	.0010
			2	.0674	−.0387	−.0226	.0050	.0011
			3	.0654	−.0388	−.0336	.0073	.0010
			4	.0656	−.0387	−.0453	.0098	−.0001
			5	.0657	−.0388	−.0564	.0120	.0001
		4	0	.1189	−.0526	.0011	−.0002	.0008
			1	.1205	−.0532	−.0103	.0021	.0007
			2	.1220	−.0533	−.0220	.0047	.0008
2	0	0	0	.0068	−.0106	−.0001	0	.0002
			0	.0094	−.0104	−.0001	−.0001	.0004
			1	.0092	−.0104	−.0107	.0025	−.0005
			1	.0084	−.0103	−.0118	.0025	.0004
			2	.0081	−.0104	−.0225	.0049	−.0005
			2	.0062	−.0098	−.0232	.0051	.0006
			3	.0075	−.0107	−.0344	.0074	−.0005
			3	.0052	−.0100	−.0347	.0075	.0006
			4	.0075	−.0110	−.0456	.0099	−.0004
			4	.0058	−.0105	−.0467	.0100	.0008
			5	.0075	−.0113	−.0574	.0122	−.0002
			5	.0030	−.0104	−.0589	.0123	.0007
		2	0	.0568	−.0252	.0006	−.0001	.0004
			1	.0581	−.0250	−.0103	.0023	0
			2	.0582	−.0251	−.0217	.0049	.0001
			3	.0585	−.0257	−.0336	.0074	−.0001
			4	.0593	−.0259	−.0449	.0097	.0002
			5	.0595	−.0262	−.0566	.0120	0
			5	.0573	−.0259	−.0580	.0121	.0009

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$\left[\text{Body-axis data; } M = 4.06; \ R = 2.7 \times 10^6\right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
				(a) $BWT_H T_{VU} T_{VL}$ - Continued				
2	0	4	0	0.1143	-0.0394	0.0014	-0.0002	0.0003
			1	.1125	-.0386	-.0093	.0021	.0003
			2	.1125	-.0387	-.0216	.0048	.0003
			3	.1127	-.0386	-.0328	.0071	.0001
			4	.1127	-.0388	-.0449	.0097	.0001
		6	0	.1677	-.0530	.0024	-.0002	.0005
			1	.1675	-.0526	-.0091	.0021	.0003
			2	.1678	-.0523	-.0211	.0047	.0004
0	4	0	0	-.0032	.0025	.0174	-.0114	.0002
			0	-.0007	.0011	.0177	-.0118	.0011
			1	-.0027	.0022	.0055	-.0087	.0001
			1	-.0007	.0012	.0060	-.0091	.0010
			2	-.0005	.0016	-.0058	-.0061	.0001
			2	-.0001	.0012	-.0054	-.0064	.0007
			3	-.0016	.0014	-.0176	-.0036	.0001
			3	-.0012	.0011	-.0173	-.0039	.0005
			4	-.0011	.0011	-.0283	-.0014	.0002
			5	-.0016	.0010	-.0401	.0014	.0001
			6	-.0021	.0011	-.0527	.0036	.0000
			7	-.0021	.0012	-.0663	.0062	-.0004
			8	-.0005	.0012	-.0798	.0086	-.0004
		2	1	.0487	-.0120	.0060	-.0089	.0008
			2	.0505	-.0122	-.0053	-.0063	.0008
			3	.0484	-.0118	-.0170	-.0037	.0005
			4	.0515	-.0127	-.0286	-.0012	.0003
			5	.0487	-.0128	-.0416	.0016	.0006
			6	.0511	-.0128	-.0546	.0039	.0002
			7	.0516	-.0130	-.0684	.0066	.0004

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
				(a) $BWT_HT_{VU}T_{VL}$ - Continued				
0	4	4	1	0.1050	-0.0247	0.0075	-0.0091	0.0005
			2	-.1054	-.0245	-.0045	.0064	.0005
			3	.1044	-.0245	-.0163	-.0039	.0003
			4	.1043	-.0242	-.0284	-.0014	.0001
			5	.1036	-.0248	-.0414	.0014	.0002
			6	.1058	-.0250	-.0554	.0039	.0004
			7	.1087	-.0254	-.0693	.0066	.0000
		6	2	.1596	-.0376	-.0039	-.0068	.0002
			3	.1588	-.0366	-.0161	-.0042	.0000
			4	.1588	-.0366	-.0293	-.0014	-.0003
			5	.1570	-.0364	-.0426	.0013	.0003
			6	.1618	-.0366	-.0565	.0039	.0003
			7	.1610	-.0364	-.0699	.0067	-.0003
			8	.1609	-.0359	-.0837	.0090	-.0009
		8	4	.2192	-.0497	-.0291	-.0017	-.0006
			5	.2188	-.0497	-.0440	.0014	-.0006
0	2	0	0	-.0033	.0018	.0081	-.0056	.0011
			1	-.0034	.0017	-.0033	-.0029	.0014
			2	-.0023	.0014	-.0146	-.0005	.0013
			3	-.0018	.0011	-.0262	.0018	.0012
			4	-.0029	.0012	-.0380	.0044	.0014
			5	-.0023	.0012	-.0499	.0069	.0013
			6	-.0012	.0013	-.0626	.0093	.0010
			7	-.0012	.0013	-.0764	.0118	.0007
			8	-.0012	.0013	-.0887	.0139	.0006
		2	0	.0513	-.0124	.0093	-.0057	.0003
			1	.0513	-.0125	-.0020	-.0032	.0005
			2	.0514	-.0128	-.0136	-.0004	.0006
			3	.0512	-.0133	-.0249	.0017	.0006
			4	.0515	-.0133	-.0367	.0042	.0005
			5	.0519	-.0134	-.0491	.0066	.0005
			6	.0522	-.0136	-.0619	.0091	.0004
			7	.0526	-.0138	-.0757	.0118	.0008

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(a) $BWT_HT_{VU}T_{VL}$ - Continued								
0	2	4	0	0.1039	-0.0246	0.0100	-0.0059	-0.0001
			1	.1039	-.0248	-.0015	-.0034	.0000
			2	.1039	-.0247	-.0136	-.0007	.0000
			3	.1044	-.0249	-.0250	.0017	.0000
			4	.1049	-.0250	-.0377	.0042	.0000
			5	.1049	-.0252	-.0495	.0067	.0000
			6	.1054	-.0254	-.0633	.0093	-.0001
			7	.1064	-.0253	-.0771	.0120	-.0001
		6	0	.1553	-.0371	.0109	-.0059	-.0005
			1	.1553	-.0369	-.0010	-.0034	-.0005
			2	.1587	-.0374	-.0130	-.0010	-.0007
			3	.1592	-.0371	-.0255	.0016	-.0005
			4	.1594	-.0371	-.0381	.0042	-.0006
			5	.1589	-.0367	-.0506	.0068	-.0006
			6	.1596	-.0366	-.0635	.0094	-.0005
		8	2	.2157	-.0501	-.0130	-.0011	-.0017
			3	.2148	-.0496	-.0251	.0014	-.0014
			4	.2150	-.0493	-.0379	.0041	-.0012
0	0	Table II (a) ref. 2						
0	-2	0	0	-.0018	.0014	-.0100	.0058	.0011
			1	-.0002	.0011	-.0211	.0084	.0013
			2	-.0002	.0009	-.0325	.0108	.0012
			3	-.0007	.0006	-.0443	.0133	.0013
			3	-.0037	.0013	-.0440	.0133	.0003
		2	0	.0499	-.0127	-.0087	.0058	.0013
			1	.0525	-.0130	-.0197	.0082	.0005
			2	.0527	-.0131	-.0313	.0107	.0006
			3	.0495	-.0131	-.0433	.0132	.0005

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$$\left[\text{Body-axis data; } M = 4.06; \ R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(a) $BWT_H T_{VU} T_{VL}$ - Continued								
0	-2	4	0	0.1050	-0.0258	-0.0078	0.0057	0.0010
			1	.1057	-.0257	-.0188	.0081	.0005
			2	.1053	-.0255	-.0308	.0107	.0005
			3	.1034	-.0255	-.0429	.0130	.0005
		6	0	.1584	-.0387	-.0073	.0057	.0011
			1	.1586	-.0387	-.0187	.0082	.0007
			2	.1585	-.0380	-.0305	.0106	.0005
0	-4	0	0	-.0037	.0019	-.0192	.0120	.0003
		2	0	.0507	-.0125	-.0181	.0120	.0006
		4	0	.1074	-.0261	-.0172	.0119	.0008
-2	0	0	0	-.0065	.0114	-.0006	.0001	.0008
			0	-.0075	.0116	0	0	0
			1	-.0039	.0112	-.0120	.0026	.0015
			1	-.0080	.0116	-.0113	.0025	-.0002
			2	-.0059	.0115	-.0228	.0050	.0003
			2	-.0080	.0117	-.0231	.0050	.0001
			3	-.0080	.0120	-.0340	.0073	.0005
			3	-.0080	.0115	-.0343	.0074	0
			4	-.0106	.0114	-.0472	.0100	.0007
			4	-.0085	.0113	-.0461	.0100	-.0001
			5	-.0085	.0118	-.0576	.0123	.0001
		2	0	.0436	-.0010	.0003	.0001	.0009
			1	.0430	-.0016	-.0112	.0025	.0010
			2	.0428	-.0011	-.0222	.0050	.0007
			3	.0400	-.0006	-.0336	.0072	.0004
			4	.0410	-.0016	-.0464	.0099	.0008
			5	.0435	-.0016	-.0575	.0121	0

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$\left[\text{Body-axis data; M} = 4.06; \text{R} = 2.7 \times 10^6\right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(a) $BWT_H T_{VU} T_{VL}$ - Continued								
-2	0	4	0	0.0979	-0.0131	0.0009	0	0.0011
			1	.0958	-.0132	-.0099	.0023	.0011
			2	.0974	-.0131	-.0217	.0050	.0006
			3	.0964	-.0126	-.0327	.0070	.0004
			4	.0968	-.0134	-.0463	.0099	.0010
			5	.0979	-.0133	-.0573	.0123	.0005
		6	0	.1518	-.0257	.0018	-.0001	.0010
			1	.1491	-.0257	-.0095	.0023	.0009
			2	.1507	-.0254	-.0219	.0048	.0004
			3	.1501	-.0241	-.0327	.0070	.0004
			4	.1507	-.0250	-.0474	.0100	.0010
			5	.1496	-.0241	-.0592	.0125	.0005
		8	0	.2078	-.0381	.0035	-.0002	.0005
			1	.2085	-.0394	-.0090	.0024	.0009
			2	.2083	-.0383	-.0219	.0050	.0006
			3	.2062	-.0372	-.0331	.0071	0
-4	0	0	0	-.0138	.0240	-.0007	0	.0010
			1	-.0101	.0229	-.0120	.0026	.0009
			2	-.0128	.0238	-.0234	.0051	.0011
			3	-.0149	.0248	-.0347	.0076	.0009
			4	-.0160	.0252	-.0467	.0100	.0009
			5	-.0160	.0264	-.0579	.0123	.0010
		2	0	.0330	.0117	-.0003	-.0001	.0011
			1	.0365	.0114	-.0108	.0024	.0006
			2	.0365	.0112	-.0226	.0050	.0005
			3	.0359	.0114	-.0339	.0074	.0006
			4	.0348	.0120	-.0456	.0099	.0008
			5	.0348	.0123	-.0574	.0122	.0008

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$\left[\text{Body-axis data; } M = 4.06; \ R = 2.7 \times 10^6\right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(a) $BWT_H T_{VU} T_{VL}$ - Continued								
-4	0	4	0	0.0888	-0.0005	0.0007	-0.0001	0.0014
			1	.0894	-.0003	-.0099	.0022	.0003
			2	.0896	-.0004	-.0219	.0049	.0004
			3	.0899	-.0001	-.0332	.0073	.0002
			4	.0876	.0004	-.0454	.0098	.0003
			5	.0878	.0006	-.0569	.0121	.0003
		6	0	.1415	-.0123	.0017	-.0001	.0016
			1	.1422	-.0125	-.0097	.0023	.0004
			2	.1416	-.0123	-.0223	.0048	.0006
			3	.1410	-.0114	-.0344	.0073	.0010
			4	.1412	-.0109	-.0473	.0100	.0010
			5	.1417	-.0104	-.0597	.0124	.0013
		8	0	.1986	-.0260	.0027	-.0002	.0014
			1	.1994	-.0259	-.0090	.0023	-.0001
			2	.1994	-.0253	-.0224	.0051	.0002
			3	.2001	-.0250	-.0348	.0075	.0006
			4	.2006	-.0245	-.0479	.0102	.0008
			5	.2008	-.0240	-.0609	.0128	.0011
		10	0	.2693	-.0455	.0038	-.0002	.0017
			1	.2669	-.0445	-.0101	.0026	.0002
-6	0	0	0	-.0237	.0380	-.0010	0	.0006
			1	-.0180	.0365	-.0113	.0027	.0003
			1	-.0209	.0372	-.0113	.0025	.0003
			2	-.0206	.0372	-.0226	.0051	-.0001
			2	-.0214	.0374	-.0231	.0051	.0002
			3	-.0207	.0373	-.0338	.0076	-.0002
			3	-.0223	.0374	-.0344	.0075	.0003
			4	-.0207	.0378	-.0453	.0100	-.0003
			4	-.0227	.0374	-.0462	.0100	.0003
			5	-.0213	.0382	-.0567	.0123	-.0005
			5	-.0209	.0375	-.0579	.0123	.0003
			6	-.0211	.0376	-.0659	.0133	-.0008

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$$\left[\text{Body-axis data}; \; M = 4.06; \; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	c_N	c_m	c_Y	c_n	c_l
				(a) $BWT_HT_{VU}T_{VL}$ - Continued				
−6	0	2	0	0.0240	0.0245	−0.0002	0.0001	0.0008
			1	.0272	.0240	−.0115	.0026	.0003
			2	.0268	.0248	−.0228	.0052	.0002
			3	.0269	.0248	−.0342	.0076	.0001
			4	.0287	.0248	−.0448	.0097	−.0004
			5	.0253	.0250	−.0576	.0123	.0005
		4	0	.0793	.0132	.0007	0	.0008
			1	.0803	.0127	−.0103	.0024	.0005
			2	.0811	.0132	−.0224	.0051	.0004
			3	.0806	.0137	−.0336	.0074	.0002
			4	.0806	.0143	−.0446	.0097	.0001
			5	.0786	.0140	−.0577	.0123	.0009
		6	0	.1325	.0017	.0016	−.0001	.0007
			1	.1329	.0010	−.0101	.0024	.0004
			2	.1352	.0017	−.0221	.0049	.0003
			3	.1339	.0027	−.0335	.0074	.0001
			4	.1330	.0036	−.0462	.0098	−.0002
			5	.1318	.0036	−.0593	.0125	.0009
		8	0	.1868	−.0121	.0027	−.0002	.0007
			1	.1876	−.0124	−.0096	.0025	.0005
			2	.1905	−.0118	−.0226	.0052	.0005
			3	.1898	−.0110	−.0342	.0076	0
			4	.1937	−.0110	−.0468	.0101	.0001
			5	.1908	−.0107	−.0610	.0129	.0012
		10	0	.2588	−.0320	.0039	−.0003	.0002
			1	.2561	−.0316	−.0106	.0028	−.0002
			2	.2589	−.0309	−.0232	.0053	.0003
			3	.2608	−.0306	−.0352	.0076	−.0001

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$\left[\text{Body-axis data; M = 4.06; R = 2.7} \times 10^6\right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
				(a) $BWT_HT_{VU}T_{VL}$ - Continued				
-8	0	0	0	-0.0332	0.0514	-0.0011	0.0001	0.0003
			1	-.0316	.0513	-.0122	.0026	-.0001
			2	-.0279	.0503	-.0236	.0052	-.0002
			3	-.0290	.0508	-.0350	.0076	-.0002
			3	-.0330	.0509	-.0353	.0078	.0012
			4	-.0290	.0513	-.0468	.0102	-.0005
			5	-.0279	.0486	-.0559	.0114	-.0008
			6	-.0259	.0453	-.0641	.0118	-.0007
		2	0	.0184	.0368	-.0005	.0002	.0001
			1	.0168	.0371	-.0114	.0026	.0003
			2	.0188	.0377	-.0227	.0051	-.0001
			3	.0161	.0373	-.0349	.0077	.0012
			4	.0178	.0384	-.0464	.0101	.0008
			5	.0168	.0390	-.0575	.0124	.0006
		4	0	.0721	.0264	.0007	0	.0002
			1	.0720	.0259	-.0105	.0025	.0002
			2	.0721	.0268	-.0223	.0051	-.0002
			3	.0692	.0268	-.0344	.0075	.0016
			4	.0722	.0279	-.0465	.0100	.0012
			5	.0724	.0281	-.0579	.0124	.0010
		6	0	.1247	.0147	.0013	0	.0001
			1	.1253	.0144	-.0103	.0024	.0002
			2	.1261	.0155	-.0219	.0050	-.0002
			3	.1231	.0159	-.0348	.0075	.0017
			4	.1254	.0171	-.0472	.0101	.0014
			5	.1238	.0182	-.0586	.0126	.0012
		8	0	.1869	-.0021	.0024	0	0
			1	.1808	-.0003	-.0095	.0025	.0001
			2	.1831	.0008	-.0222	.0052	.0002
			3	.1811	.0012	-.0354	.0077	.0017
			4	.1840	.0022	-.0485	.0103	.0014
			5	.1837	.0033	-.0607	.0130	.0014

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(a) $BWT_H T_{VU} T_{VL}$ - Concluded								
-8	0	10	0	0.2532	-0.0206	0.0035	-0.0001	-0.0001
			1	.2519	-.0200	-.0107	.0028	.0001
			2	.2530	-.0194	-.0226	.0053	-.0003
			3	.2522	-.0185	-.0363	.0078	.0020
			4	.2521	-.0172	-.0502	.0107	.0017
		12	0	.3185	-.0352	.0052	-.0003	-.0001
			1	.3162	-.0349	-.0099	.0028	-.0001
			2	.3177	-.0342	-.0232	.0053	-.0001
(b) $BWT_H T_{VU}$								
0	6	0	0	-.0041	.0081	.0129	-.0088	.0027
			1	-.0035	.0079	.0049	-.0082	.0019
			2	-.0034	.0076	-.0033	-.0077	.0012
			3	-.0061	.0080	-.0115	-.0073	.0002
			4	-.0065	.0081	-.0209	-.0069	.0010
			6	-.0063	.0082	-.0399	-.0053	-.0003
			8	-.0061	.0085	-.0620	-.0034	-.0013
		2	0	.0479	-.0051	.0126	-.0080	.0025
			1	.0466	-.0040	.0048	-.0078	.0016
			2	.0480	-.0052	-.0032	-.0076	.0005
			3	.0462	-.0040	-.0107	-.0073	-.0003
			4	.0462	-.0054	-.0203	-.0071	.0006
			6	.0465	-.0047	-.0385	-.0059	-.0009
			8	.0478	-.0046	-.0611	-.0040	-.0019
		4	0	.1027	-.0177	.0126	-.0074	.0021
			1	.1020	-.0174	.0051	-.0075	.0012
			2	.1020	-.0173	-.0029	-.0075	.0005
			3	.1004	-.0167	-.0105	-.0074	-.0007
			4	.0993	-.0165	-.0194	-.0074	.0001
			6	.1008	-.0162	-.0382	-.0064	-.0010
			8	.1022	-.0152	-.0607	-.0045	-.0025

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$$\left[\text{Body-axis data; } M = 4.06; \ R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
				(b) $BWT_H T_{VU}$ - Continued				
0	6	6	0	0.1553	−0.0303	0.0127	−0.0069	0.0016
			1	.1572	−.0303	.0052	−.0071	.0010
			2	.1556	−.0295	−.0025	−.0074	−.0002
			3	.1543	−.0286	−.0107	−.0075	−.0012
			4	.1540	−.0283	−.0201	−.0076	.0000
			6	.1537	−.0265	−.0391	−.0067	−.0018
			8	.1554	−.0255	−.0612	−.0049	−.0037
		8	6	.2112	−.0383	−.0404	−.0068	−.0023
			8	.2115	−.0363	−.0626	−.0053	−.0039
0	4	0	0	−.0009	.0066	.0080	−.0058	.0024
			1	−.0029	.0069	.0002	−.0052	.0016
			2	−.0034	.0071	−.0077	−.0048	.0011
			3	−.0088	.0087	−.0159	−.0044	.0000
			4	−.0041	.0072	−.0251	−.0040	−.0006
			6	−.0066	.0085	−.0440	−.0025	−.0016
			8	−.0065	.0091	−.0668	−.0005	−.0026
		2	0	.0453	−.0041	.0080	−.0053	.0022
			1	.0474	−.0042	.0007	−.0051	.0012
			2	.0476	−.0042	−.0069	−.0049	.0005
			3	.0452	−.0044	−.0147	−.0047	−.0004
			4	.0465	−.0041	−.0243	−.0045	−.0010
			6	.0495	−.0038	−.0428	−.0035	−.0020
			8	.0497	−.0034	−.0656	−.0015	−.0033
		4	0	.1038	−.0180	.0085	−.0050	.0018
			1	.1019	−.0174	.0015	−.0050	.0012
			2	.1012	−.0174	−.0062	−.0051	.0006
			3	.0997	−.0173	−.0143	−.0050	−.0006
			4	.1020	−.0164	−.0229	−.0050	−.0010
			6	.1035	−.0164	−.0425	−.0041	−.0020
			8	.1060	−.0153	−.0646	−.0023	−.0038

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$$\left[\text{Body-axis data; } M = 4.06; \ R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	c_N	c_m	c_Y	c_n	c_l
(b) BWT_HT_{VU} - Continued								
0	4	6	0	0.1588	−0.0310	0.0092	−0.0046	0.0017
			1	.1556	−.0301	.0014	−.0049	.0008
			2	.1559	−.0297	−.0057	−.0052	−.0001
			3	.1538	−.0284	−.0142	−.0054	−.0011
			4	.1565	−.0287	−.0235	−.0054	−.0016
			6	.1563	−.0269	−.0425	−.0046	−.0028
			8	.1581	−.0257	−.0650	−.0029	−.0043
		8	2	.2117	−.0416	−.0069	−.0053	−.0008
			3	.2114	−.0410	−.0161	−.0056	−.0014
			4	.2135	−.0407	−.0241	−.0056	−.0018
			6	.2145	−.0389	−.0436	−.0049	−.0028
			8	.2159	−.0367	−.0655	−.0034	−.0048
0	2	0	0	−.0038	.0073	.0036	−.0029	.0010
			1	−.0038	.0073	−.0043	−.0024	.0005
			2	−.0042	.0073	−.0123	−.0021	−.0002
			3	−.0063	.0081	−.0139	−.0017	−.0003
			4	−.0061	.0082	−.0293	−.0013	−.0011
			5	−.0066	.0085	−.0384	−.0006	−.0016
			6	−.0070	.0089	−.0486	.0001	−.0022
			7	−.0064	.0094	−.0599	.0011	−.0028
			7	−.0049	.0087	−.0597	.0008	−.0024
			8	−.0058	.0096	−.0709	.0021	−.0034
			8	−.0048	.0090	−.0710	.0020	−.0028
		2	0	.0496	−.0057	.0046	−.0027	.0005
			1	.0451	−.0034	−.0032	−.0026	.0007
			2	.0474	−.0040	−.0108	−.0024	.0001
			3	.0476	−.0040	−.0190	−.0023	−.0006
			4	.0468	−.0038	−.0267	−.0020	−.0014
			5	.0466	−.0038	−.0361	−.0016	−.0020
			6	.0467	−.0041	−.0467	−.0010	−.0022
			7	.0485	−.0038	−.0574	−.0002	−.0028
			8	.0508	−.0043	−.0688	.0007	−.0033

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	c_N	c_m	c_Y	c_n	c_l
(b) BWT_HT_{VU} - Continued									
0	2	4	0	0.1016	-0.0175	0.0053	-0.0025	0.0002
			1	.1002	-.0173	-.0024	-.0027	.0004
			2	.1023	-.0176	-.0101	-.0028	-.0002
			3	.1005	-.0168	-.0177	-.0028	-.0008
			4	.1006	-.0164	-.0259	-.0027	-.0016
			5	.1014	-.0159	-.0348	-.0024	-.0024
			6	.1004	-.0157	-.0458	-.0018	-.0024
			7	.1028	-.0150	-.0563	-.0012	-.0029
			8	.1040	-.0147	-.0678	-.0001	-.0036
		6	0	.1577	-.0307	.0058	-.0024	-.0004
			1	.1555	-.0302	-.0016	-.0027	.0000
			2	.1550	-.0295	-.0091	-.0030	-.0007
			3	.1560	-.0291	-.0175	-.0033	-.0015
			4	.1545	-.0279	-.0260	-.0033	-.0020
			5	.1545	-.0273	-.0343	-.0030	-.0027
			6	.1558	-.0264	-.0456	-.0026	-.0029
			7	.1545	-.0256	-.0561	-.0019	-.0034
			8	.1557	-.0252	-.0672	-.0010	-.0041
		8	0	.2155	-.0448	.0069	-.0022	-.0008
			1	.2119	-.0427	-.0009	-.0027	.0001
			2	.2118	-.0417	-.0097	-.0033	-.0007
			3	.2109	-.0407	-.0172	-.0036	-.0014
			4	.2114	-.0399	-.0260	-.0037	-.0022
			5	.2124	-.0392	-.0350	-.0035	-.0030
			6	.2127	-.0382	-.0463	-.0030	-.0031
			7	.2110	-.0364	-.0571	-.0024	-.0037
			8	.2134	-.0358	-.0682	-.0016	-.0048

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(b) $BWT_H T_{VU}$ - Continued							
0	0	0	0	−0.0016	0.0063	−0.0009	0.0000	−0.0001
			1	−.0052	.0073	−.0088	.0004	−.0006
			2	−.0051	.0075	−.0170	.0008	−.0010
			3	−.0056	.0077	−.0253	.0012	−.0014
			4	−.0065	.0081	−.0337	.0017	−.0019
			5	−.0075	.0085	−.0428	.0023	−.0025
			6	−.0069	.0092	−.0534	.0031	−.0033
			7	−.0062	.0097	−.0649	.0040	−.0039
			8	−.0062	.0102	−.0760	.0051	−.0043
		2	0	.0488	−.0056	.0003	.0000	−.0008
			1	.0486	−.0057	−.0072	.0001	−.0011
			2	.0476	−.0057	−.0149	.0003	−.0016
			3	.0476	−.0058	−.0231	.0004	−.0022
			4	.0477	−.0056	−.0313	.0006	−.0027
			5	.0477	−.0051	−.0402	.0011	−.0032
			6	.0477	−.0038	−.0504	.0016	−.0038
			7	.0483	−.0037	−.0619	.0026	−.0043
			8	.0489	−.0034	−.0733	.0036	−.0047
		4	0	.1023	−.0181	.0013	.0000	.0012
			1	.1018	−.0181	−.0062	−.0003	.0007
			2	.1007	−.0178	−.0140	−.0003	−.0001
			3	.1008	−.0174	−.0218	−.0003	−.0005
			4	.1019	−.0170	−.0301	−.0003	−.0009
			5	.1020	−.0166	−.0393	.0001	−.0015
			6	.1005	−.0158	−.0497	.0006	−.0020
			7	.1017	−.0149	−.0611	.0014	−.0029
			8	.1022	−.0141	−.0722	.0023	−.0037

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(b) $BWT_H T_{VU}$ - Continued								
0	0	6	0	0.1580	-0.0314	0.0022	-0.0001	0.0004
			1	.1582	-.0311	-.0051	-.0005	-.0003
			2	.1579	-.0305	-.0126	-.0008	-.0007
			3	.1559	-.0292	-.0207	-.0010	-.0013
			4	.1562	-.0287	-.0293	-.0010	-.0017
			5	.1549	-.0273	-.0383	-.0008	-.0024
			6	.1563	-.0263	-.0483	-.0004	-.0031
			7	.1570	-.0257	-.0591	.0003	-.0044
			8	.1580	-.0245	-.0700	.0011	-.0051
		8	0	.2104	-.0424	.0037	-.0001	-.0003
			1	.2107	-.0421	-.0035	-.0006	-.0008
			2	.2103	-.0414	-.0120	-.0013	-.0013
			3	.2097	-.0403	-.0199	-.0017	-.0020
			4	.2108	-.0396	-.0282	-.0019	-.0024
			5	.2121	-.0387	-.0372	-.0017	-.0028
			6	.2108	-.0375	-.0483	-.0012	-.0035
			7	.2124	-.0364	-.0596	-.0005	-.0041
			8	.2144	-.0355	-.0710	.0002	-.0049
0	-2	0	0	-.0037	.0071	-.0051	.0029	.0002
			1	-.0036	.0072	-.0132	.0033	-.0003
			2	-.0046	.0077	-.0217	.0037	-.0008
			3	-.0061	.0082	-.0298	.0041	-.0014
			4	-.0060	.0084	-.0382	.0046	-.0019
			5	-.0059	.0088	-.0473	.0051	-.0025
			6	-.0058	.0095	-.0577	.0059	-.0033
			7	-.0063	.0104	-.0688	.0069	-.0037
			8	-.0062	.0126	-.0805	.0081	-.0043

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$

i_H	i_V	α	β	c_N	c_m	c_Y	c_n	c_l
(b) BWT_HT_{VU} - Continued
0	-2	2	0	0.0474	-0.0054	-0.0035	0.0026	-0.0002
			1	.0475	-.0054	-.0122	.0028	-.0011
			2	.0475	-.0054	-.0192	.0029	-.0017
			3	.0469	-.0054	-.0272	.0030	-.0020
			4	.0469	-.0046	-.0358	.0033	-.0025
			5	.0470	-.0044	-.0445	.0037	-.0031
			6	.0475	-.0036	-.0546	.0042	-.0037
			7	.0481	-.0034	-.0655	.0051	-.0041
			8	.0482	-.0028	-.0768	.0062	-.0045
		4	0	.1013	-.0179	-.0024	.0024	-.0003
			1	.1022	-.0178	-.0095	.0022	-.0012
			2	.1017	-.0175	-.0173	.0022	-.0018
			3	.1019	-.0169	-.0251	.0021	-.0026
			4	.1010	-.0163	-.0335	.0022	-.0030
			5	.1003	-.0154	-.0427	.0025	-.0034
			6	.1010	-.0146	-.0533	.0030	-.0040
			7	.1017	-.0137	-.0640	.0037	-.0046
			8	.1025	-.0127	-.0755	.0047	-.0053
		6	0	.1559	-.0304	-.0010	.0021	-.0005
			1	.1557	-.0300	-.0084	.0018	-.0008
			2	.1553	-.0295	-.0160	.0014	-.0016
			3	.1552	-.0286	-.0243	.0012	-.0024
			4	.1554	-.0279	-.0333	.0011	-.0036
			5	.1545	-.0266	-.0418	.0014	-.0042
			6	.1551	-.0257	-.0522	.0018	-.0048
			7	.1557	-.0252	-.0629	.0025	-.0053
			8	.1563	-.0234	-.0742	.0034	-.0057
		8	0	.2108	-.0425	.0002	.0019	-.0005
			1	.2134	-.0426	-.0071	.0015	-.0014
			2	.2130	-.0417	-.0153	.0009	-.0021
			3	.2121	-.0410	-.0238	.0001	-.0026
			4	.2122	-.0399	-.0321	.0004	-.0032
			5	.2129	-.0390	-.0416	.0006	-.0038
			6	.2138	-.0381	-.0524	.0010	-.0046
			7	.2113	-.0361	-.0629	.0017	-.0054
			8	.2114	-.0348	-.0748	.0024	-.0060

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$\left[\text{Body-axis data; } M = 4.06; \ R = 2.7 \times 10^6 \right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
			(b)	$BWT_H T_{VU}$ - Continued				
0	-4	0	0	-0.0046	0.0077	-0.0097	0.0058	-0.0006
			1	-.0056	.0082	-.0179	.0063	-.0014
			2	-.0055	.0085	-.0259	.0066	-.0021
			3	-.0054	.0086	-.0340	.0069	-.0034
			4	-.0053	.0079	-.0421	.0074	-.0038
			6	-.0077	.0126	-.0625	.0089	-.0043
			8	-.0060	.0133	-.0853	.0110	-.0055
		2	0	.0460	-.0043	-.0085	.0052	-.0007
			1	.0473	-.0044	-.0158	.0053	-.0011
			2	.0486	-.0047	-.0238	.0055	-.0020
			3	.0462	-.0043	-.0311	.0058	-.0033
			4	.0460	-.0042	-.0404	.0059	-.0039
			6	.0459	-.0028	-.0597	.0069	-.0042
			8	.0484	-.0013	-.0810	.0087	-.0056
		4	0	.1014	-.0177	-.0063	.0048	-.0007
			1	.1028	-.0177	-.0134	.0046	-.0009
			2	.1017	-.0174	-.0220	.0046	-.0022
			3	.1017	-.0164	-.0287	.0046	-.0035
			4	.1010	-.0156	-.0372	.0046	-.0045
			6	.1018	-.0148	-.0577	.0054	-.0045
			8	.1019	-.0121	-.0796	.0071	-.0062
		6	0	.1579	-.0309	-.0050	.0043	-.0006
			1	.1568	-.0303	-.0124	.0041	-.0011
			2	.1575	-.0298	-.0201	.0037	-.0030
			3	.1554	-.0283	-.0272	.0035	-.0035
			4	.1545	-.0271	-.0360	.0033	-.0044
			6	.1552	-.0257	-.0563	.0041	-.0049
			8	.1548	-.0234	-.0777	.0057	-.0061
		8	0	.2123	-.0449	-.0036	.0040	-.0008
			1	.2098	-.0421	-.0113	.0037	-.0014
			2	.2148	-.0421	-.0189	.0030	-.0024
			3	.2120	-.0403	-.0266	.0025	-.0033
			4	.2137	-.0394	-.0345	.0020	-.0044
			6	.2142	-.0377	-.0562	.0030	-.0045
			8	.2137	-.0346	-.0783	.0044	-.0061

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$$\left[\text{Body-axis data; M} = 4.06;\ R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
				(b) BWT_HT_{VU} - Continued				
0	-6	0	0	-0.0050	0.0081	-0.0142	0.0088	-0.0016
			1	-.0049	.0085	-.0224	.0092	-.0025
			2	-.0048	.0090	-.0303	.0097	-.0030
			3	-.0040	.0094	-.0387	.0101	-.0042
			4	-.0067	.0101	-.0481	.0107	-.0043
			6	-.0075	.0130	-.0669	.0119	-.0059
			8	-.0063	.0129	-.0874	.0133	-.0069
		2	0	.0471	-.0051	-.0123	.0080	-.0014
			1	.0490	-.0050	-.0191	.0081	-.0020
			2	.0466	-.0043	-.0277	.0084	-.0031
			3	.0451	-.0035	-.0356	.0086	-.0040
			4	.0454	-.0032	-.0451	.0089	-.0044
			6	.0474	-.0019	-.0634	.0097	-.0059
			8	.0467	-.0003	-.0854	.0117	-.0071
		4	0	.1019	-.0178	-.0104	.0073	-.0012
			1	.1015	-.0171	-.0179	.0072	-.0024
			2	.1034	-.0175	-.0257	.0072	-.0035
			3	.1010	-.0158	-.0333	.0073	-.0043
			4	.1002	-.0150	-.0424	.0074	-.0047
			6	.1017	-.0134	-.0611	.0081	-.0055
			8	.1014	-.0113	-.0825	.0097	-.0073
		6	0	.1551	-.0304	-.0088	.0067	-.0012
			1	.1547	-.0296	-.0161	.0065	-.0026
			2	.1570	-.0292	-.0241	.0061	-.0033
			3	.1546	-.0276	-.0313	.0059	-.0040
			4	.1544	-.0266	-.0409	.0059	-.0043
			6	.1554	-.0253	-.0598	.0066	-.0059
			8	.1547	-.0225	-.0802	.0079	-.0071

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(b) BWT_HT_{VU} - Concluded								
0	-6	8	0	0.2157	-0.0451	-0.0066	0.0063	-0.0010
			1	.2132	-.0426	-.0141	.0058	-.0016
			2	.2117	-.0411	-.0223	.0052	-.0034
			3	.2111	-.0400	-.0295	.0047	-.0041
			4	.2097	-.0382	-.0391	.0046	-.0044
			6	.2128	-.0361	-.0586	.0052	-.0059
			8	.2135	-.0334	-.0806	.0064	-.0074
(c) BWT_HT_{VL}								
0	6	0	0	.0050	-.0068	.0139	-.0093	-.0019
			1	.0016	-.0052	.0051	-.0086	-.0036
			1	.0049	-.0064	.0055	-.0088	-.0010
			2	.0039	-.0048	-.0029	-.0080	-.0013
			3	.0028	-.0054	-.0112	-.0076	-.0006
			4	.0031	-.0050	-.0202	-.0072	.0007
			6	.0046	-.0061	-.0380	-.0059	.0009
			8	.0051	-.0064	-.0603	-.0040	.0015
		2	0	.0540	-.0206	.0152	-.0101	-.0021
			1	.0543	-.0196	.0068	-.0093	-.0019
			1	.0530	-.0195	.0067	-.0094	-.0010
			2	.0532	-.0188	-.0019	-.0086	-.0015
			3	.0512	-.0184	-.0100	-.0079	-.0015
			4	.0560	-.0198	-.0194	-.0074	.0000
			6	.0557	-.0191	-.0385	-.0058	.0003
			8	.0565	-.0187	-.0605	-.0038	.0007
		4	1	.1068	-.0320	.0091	-.0100	-.0012
			2	.1086	-.0316	-.0004	-.0090	-.0023
			3	.1055	-.0306	-.0095	-.0081	-.0022
			4	.1072	-.0307	-.0193	-.0074	-.0004
			6	.1092	-.0306	-.0397	-.0054	-.0001
			8	.1106	-.0295	-.0619	-.0033	-.0001

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$\left[\text{Body-axis data; M} = 4.06; \text{R} = 2.7 \times 10^6\right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(c) $BWT_H T_{VL}$ - Continued							
0	6	6	4	0.1612	-0.0425	-0.0202	-0.0075	-0.0010
↓	↓	↓	6	.1611	-.0411	-.0409	-.0053	-.0008
			8	.1625	-.0394	-.0631	-.0029	-.0007
0	4	0	0	.0034	-.0062	.0090	-.0061	-.0012
↓	↓	↓	1	.0044	-.0060	.0010	-.0056	-.0008
			2	.0043	-.0060	-.0071	-.0050	-.0003
			3	.0033	-.0055	-.0154	-.0047	-.0002
			4	.0034	-.0064	-.0246	-.0043	.0016
			6	.0018	-.0064	-.0437	-.0029	.0022
		↓	8	.0021	-.0070	-.0659	-.0009	.0032
		2	0	.0513	-.0190	.0101	-.0066	-.0014
		↓	1	.0526	-.0189	.0021	-.0060	-.0008
			2	.0520	-.0187	-.0066	-.0053	-.0006
			3	.0517	-.0186	-.0149	-.0047	-.0005
			4	.0511	-.0192	-.0244	-.0041	.0011
			6	.0552	-.0197	-.0443	-.0025	.0018
		↓	8	.0552	-.0198	-.0670	-.0005	.0026
		4	0	.1076	-.0318	.0122	-.0071	-.0018
		↓	1	.1060	-.0313	.0018	-.0062	-.0016
			1	.1060	-.0313	.0029	-.0062	-.0016
			2	.1084	-.0315	-.0061	-.0055	-.0012
			3	.1067	-.0313	-.0145	-.0046	-.0008
			4	.1071	-.0315	-.0246	-.0038	.0007
			6	.1082	-.0315	-.0461	-.0018	.0015
		↓	8	.1104	-.0320	-.0691	.0005	.0020
		6	2	.1615	-.0437	-.0052	-.0058	-.0018
		↓	3	.1613	-.0429	-.0151	-.0047	-.0020
			4	.1605	-.0427	-.0259	-.0036	.0003
			6	.1623	-.0427	-.0477	-.0013	.0006
↓	↓	↓	8	.1626	-.0422	-.0715	.0013	.0014

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(c) BWT_HT_{VL} - Continued							
0	2	0	0	0.0010	-0.0050	0.0041	-0.0032	0.0005
			1	.0025	-.0054	-.0037	-.0028	.0011
			2	.0024	-.0054	-.0122	-.0023	.0016
			3	.0008	-.0053	-.0198	-.0021	.0016
			4	.0007	-.0058	-.0279	-.0017	.0021
			4	.0019	-.0066	-.0283	-.0016	.0015
			6	.0001	-.0062	-.0458	-.0006	.0028
			6	.0028	-.0073	-.0475	-.0003	.0026
			8	.0021	-.0077	-.0703	.0016	.0037
		2	0	.0473	-.0178	.0052	-.0035	.0004
			1	.0542	-.0194	-.0029	-.0028	.0010
			2	.0522	-.0189	-.0114	-.0023	.0012
			3	.0518	-.0190	-.0199	-.0018	.0015
			4	.0540	-.0195	-.0281	-.0013	.0017
			6	.0536	-.0195	-.0471	.0002	.0022
			8	.0556	-.0208	-.0716	.0025	.0031
		4	0	.1064	-.0313	.0068	-.0038	0
			1	.1059	-.0314	-.0022	-.0030	.0008
			2	.1072	-.0315	-.0108	-.0023	.0010
			3	.1080	-.0315	-.0202	-.0015	.0012
			4	.1075	-.0314	-.0289	-.0008	.0015
			6	.1063	-.0307	-.0491	.0011	.0020
			8	.1107	-.0324	-.0737	.0038	.0025
		6	0	.1612	-.0440	.0083	-.0042	-.0001
			1	.1588	-.0434	-.0013	-.0032	-.0003
			2	.1601	-.0435	-.0110	-.0023	.0007
			3	.1608	-.0434	-.0207	-.0013	.0010
			4	.1602	-.0422	-.0306	-.0004	.0005
			6	.1608	-.0418	-.0511	.0018	.0017
			8	.1638	-.0433	-.0765	.0049	.0024

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$\left[\text{Body-axis data; M = 4.06; R = 2.7} \times 10^6\right]$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(c) $BWT_H T_{VL}$ - Continued								
0	0	0	0	0.0026	−0.0054	−0.0003	−0.0004	0.0005
			0	.0021	−.0051	.0002	−.0004	.0001
			1	.0046	−.0059	−.0082	.0001	.0012
			1	.0021	−.0054	−.0076	−.0001	.0007
			2	.0050	−.0060	−.0163	.0004	.0017
			2	.0025	−.0060	−.0161	.0004	.0014
			3	.0019	−.0060	−.0240	.0007	.0014
			3	.0023	−.0066	−.0245	.0007	.0021
			4	.0018	−.0066	−.0319	.0011	.0019
			4	.0022	−.0072	−.0324	.0011	.0027
			5	.0022	−.0076	−.0418	.0017	.0032
			6	.0029	−.0069	−.0502	.0023	.0024
			6	.0021	−.0080	−.0518	.0024	.0033
			7	.0025	−.0084	−.0633	.0033	.0041
			8	.0014	−.0088	−.0749	.0044	.0047
		2	0	.0527	−.0189	.0005	−.0004	.0004
			1	.0538	−.0191	−.0075	.0002	.0012
			2	.0559	−.0196	−.0163	.0007	.0014
			3	.0539	−.0193	−.0240	.0012	.0014
			4	.0525	−.0194	−.0325	.0018	.0016
			6	.0540	−.0192	−.0517	.0034	.0019
			8	.0561	−.0218	−.0768	.0056	.0043
		4	0	.1061	−.0317	.0014	−.0004	.0003
			1	.1073	−.0315	−.0072	.0003	.0010
			2	.1078	−.0312	−.0163	.0009	.0013
			3	.1070	−.0310	−.0246	.0016	.0014
			4	.1057	−.0305	−.0335	.0025	.0014
			6	.1099	−.0303	−.0546	.0047	.0019
			8	.1113	−.0331	−.0796	.0073	.0039

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, AND BWT_HT_{VL}

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
				(c) BWT_HT_{VL} - Continued				
0	0	6	0	0.1610	-0.0439	0.0024	-0.0005	0.0003
			1	.1617	-.0443	-.0074	.0004	.0007
			2	.1638	-.0440	-.0164	.0011	.0007
			3	.1590	-.0427	-.0259	.0021	.0009
			4	.1630	-.0422	-.0361	.0033	.0009
			6	.1607	-.0408	-.0564	.0056	.0036
0	-2	0	0	.0023	-.0059	-.0051	.0026	.0019
			1	.0022	-.0058	-.0127	.0030	.0026
			2	.0027	-.0063	-.0209	.0034	.0031
			3	.0022	-.0072	-.0291	.0038	.0030
			4	.0010	-.0073	-.0373	.0041	.0038
			6	.0015	-.0081	-.0547	.0050	.0041
			8	.0018	-.0099	-.0795	.0074	.0055
		2	0	.0502	-.0186	-.0042	.0029	.0017
			1	.0550	-.0198	-.0132	.0035	.0024
			2	.0544	-.0200	-.0209	.0041	.0029
			3	.0535	-.0201	-.0296	.0047	.0029
			4	.0535	-.0206	-.0382	.0051	.0033
			6	.0530	-.0210	-.0583	.0064	.0039
			8	.0564	-.0234	-.0817	.0090	.0052
		4	0	.1076	-.0318	-.0038	.0028	.0016
			1	.1067	-.0318	-.0131	.0037	.0024
			2	.1066	-.0319	-.0217	.0046	.0028
			3	.1090	-.0324	-.0307	.0054	.0030
			4	.1073	-.0323	-.0400	.0061	.0033
			6	.1095	-.0329	-.0602	.0080	.0022
			8	.1101	-.0347	-.0858	.0110	.0053
		6	0	.1575	-.0435	-.0038	.0034	.0017
			1	.1603	-.0442	-.0141	.0042	.0020
			2	.1636	-.0445	-.0222	.0051	.0024
			3	.1623	-.0553	-.0319	.0060	.0023
			4	.1617	-.0439	-.0426	.0071	.0031

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$$\left[\text{Body-axis data; } M = 4.06; \, R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	c_N	c_m	c_Y	c_n	c_l
(c) $BWT_H T_{VL}$ - Continued								
0	-4	0	0	0.0022	-0.0076	-0.0093	0.0055	0.0028
			1	.0037	-.0085	-.0172	.0060	.0034
			2	.0015	-.0081	-.0256	.0064	.0040
			3	.0004	-.0085	-.0329	.0067	.0041
			4	.0003	-.0092	-.0417	.0071	.0045
			6	.0029	-.0101	-.0610	.0083	.0050
			7	.0035	-.0100	-.0715	.0091	.0054
			8	.0035	-.0106	-.0827	.0103	.0054
		2	0	.0500	-.0200	-.0091	.0060	.0026
			1	.0539	-.0212	-.0180	.0067	.0033
			2	.0539	-.0223	-.0261	.0072	.0037
			3	.0540	-.0221	-.0347	.0079	.0038
			4	.0536	-.0226	-.0436	.0086	.0045
			6	.0547	-.0228	-.0634	.0099	.0051
			7	.0557	-.0236	-.0746	.0111	.0053
			8	.0559	-.0241	-.0850	.0123	.0057
		4	0	.1075	-.0332	-.0090	.0065	.0027
			1	.1072	-.0334	-.0179	.0072	.0034
			2	.1063	-.0335	-.0267	.0080	.0036
			3	.1069	-.0337	-.0366	.0088	.0040
			4	.1081	-.0342	-.0453	.0096	.0041
			6	.1094	-.0345	-.0667	.0117	.0048
		6	0	.1605	-.0456	-.0092	.0070	.0026
			1	.1614	-.0461	-.0188	.0079	.0036
			2	.1629	-.0462	-.0278	.0089	.0035
0	-6	0	0	.0016	-.0055	-.0140	.0086	.0029
			1	.0053	-.0078	-.0219	.0090	.0036
			2	.0052	-.0079	-.0301	.0094	.0041
			3	.0042	-.0081	-.0378	.0098	.0039
			4	.0041	-.0087	-.0460	.0102	.0042
			5	.0025	-.0087	-.0544	.0107	.0046
			6	.0062	-.0102	-.0640	.0114	.0050

TABLE II.- Continued

LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS OF

MODELS $BWT_H T_{VU} T_{VL}$, $BWT_H T_{VU}$, AND $BWT_H T_{VL}$

$$\left[\text{Body-axis data; } M = 4.06; R = 2.7 \times 10^6\right]$$

i_H	i_V	α	β	C_N	C_m	C_Y	C_n	C_l
(c) $BWT_H T_{VL}$ - Concluded							
0	−6	2	0	0.0534	−0.0206	−0.0142	0.0093	0.0032
		↓	1	.0556	−.0210	−.0226	.0099	.0036
			2	.0565	−.0216	−.0312	.0104	.0039
			3	.0535	−.0211	−.0389	.0109	.0041
		↓	4	.0537	−.0218	−.0479	.0116	.0043
		4	0	.1089	−.0330	−.0147	.0100	.0032
		↓	1	.1100	−.0335	−.0233	.0108	.0037
		↓	2	.1096	−.0331	−.0324	.0114	.0042
↓	↓	6	0	.1644	−.0461	−.0152	.0109	.0036
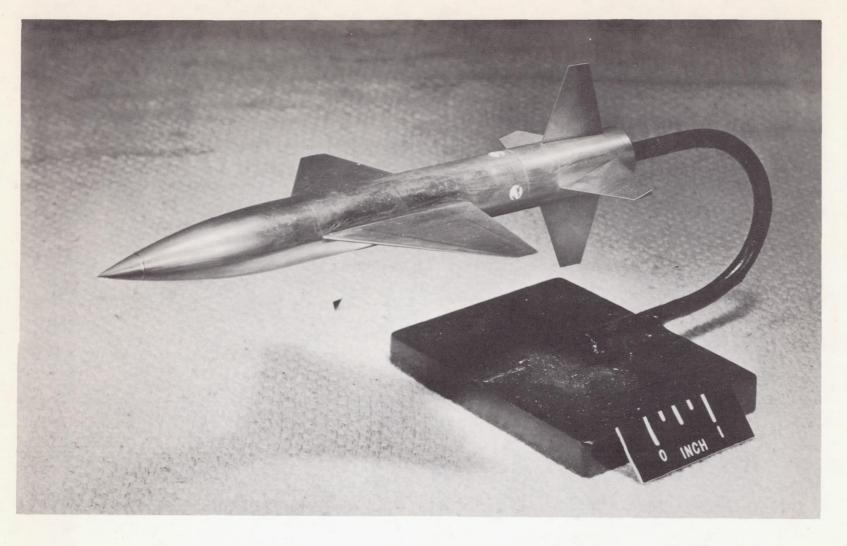
Figure 1.- Photograph of complete model. $i_H = -8^{\circ}$; $i_V = 0^{\circ}$.

L-88040
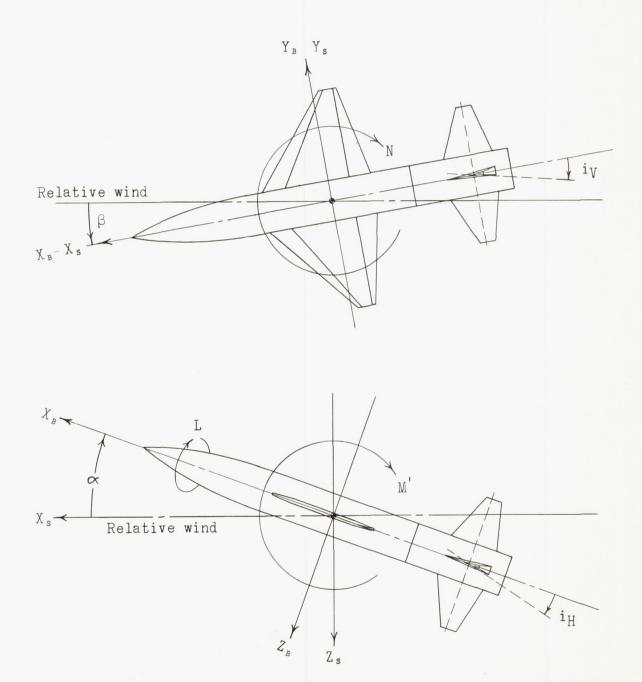
Figure 2.- Systems of reference axes; arrows indicate positive direction.
Subscript B indicates body axes; subscript S indicates stability
axes.
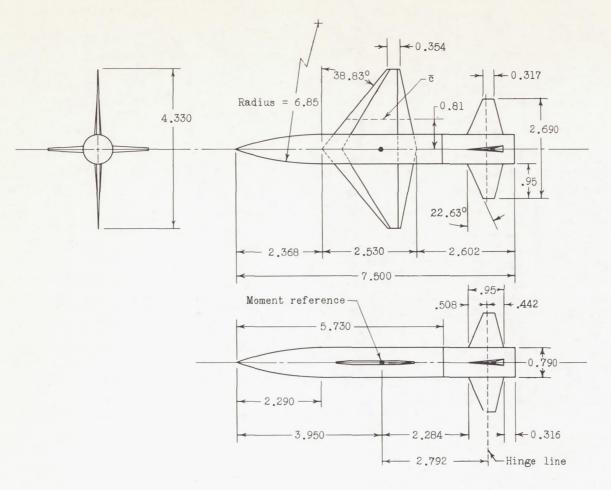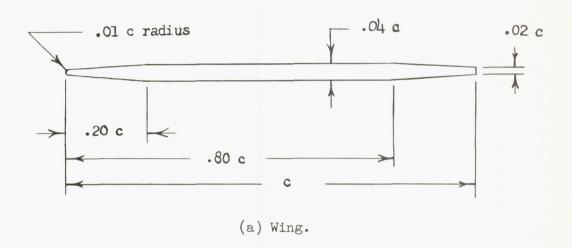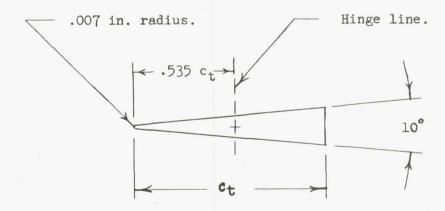
Figure 3.- Wind-tunnel model; all dimensions in inches.

(a) Wing.

(b) Horizontal and vertical tails.

Figure 4.- Wing and tail airfoil sections used on model.
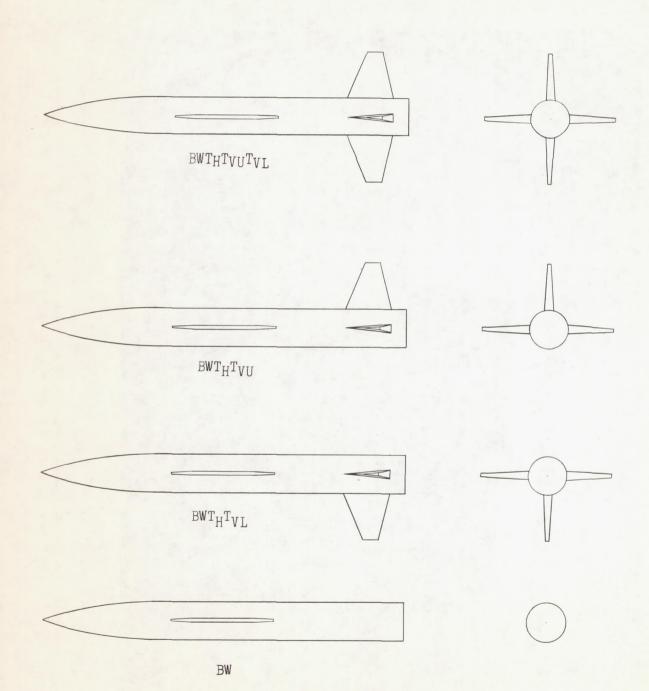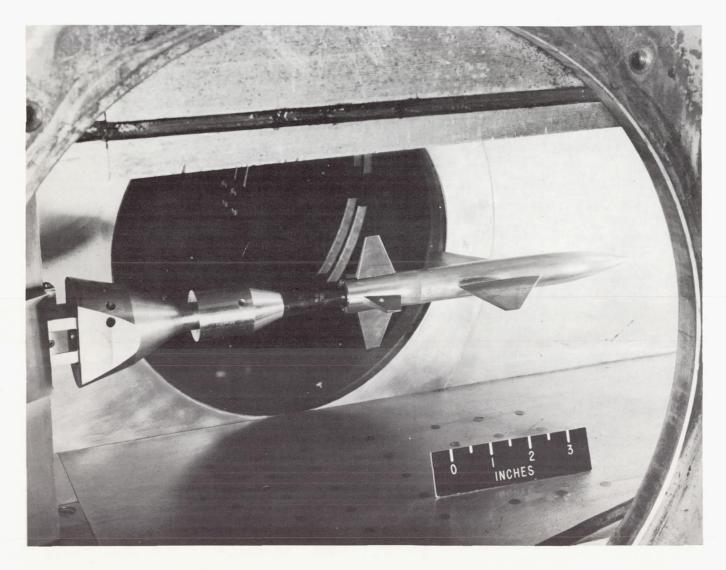
Figure 5.- Model designations.

L-87425

Figure 6.- Installation of the complete model in the Langley 9- by 9-inch
Mach number 4 blowdown jet.
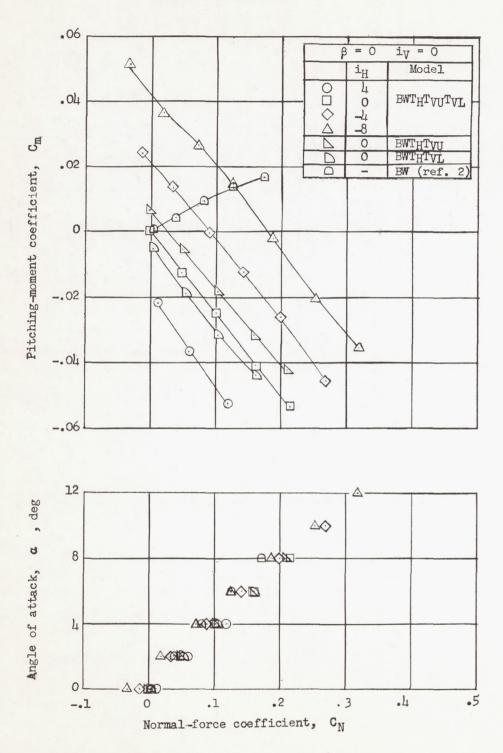
Figure 7.- Variation of the pitching-moment coefficient and angle of
attack with normal-force coefficient at various horizontal-tail inci-
dence angles for models $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, and BWT_HT_{VL}. M = 4.06;
R = 2.7 × 10^6.
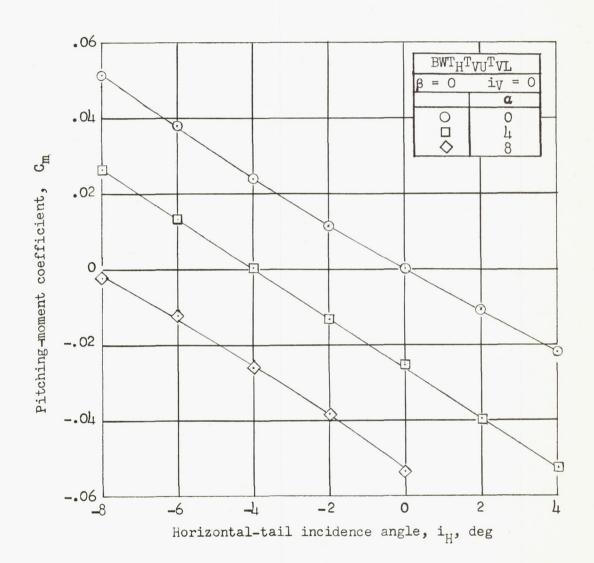
Figure 8.- Variation of pitching-moment coefficient with horizontal-tail
incidence angle at various angles of attack for model $BWT_HT_{VU}T_{VL}$.
$M = 4.06$; $R = 2.7 \times 10^6$.
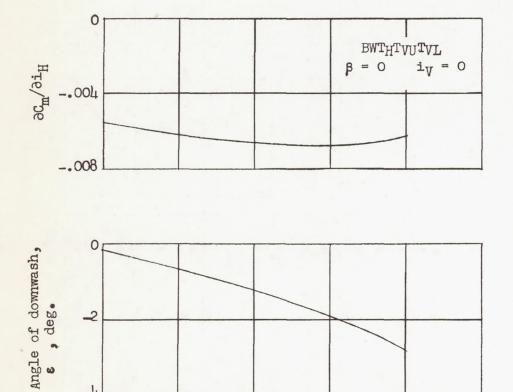
Figure 9.- Variation with angle of attack of the downwash angle and the stabilizer effectiveness parameter $\partial C_m / \partial i_H$ for model $BWT_H T_{VU} T_{VL}$ at trim conditions. $M = 4.06$; $R = 2.7 \times 10^6$.
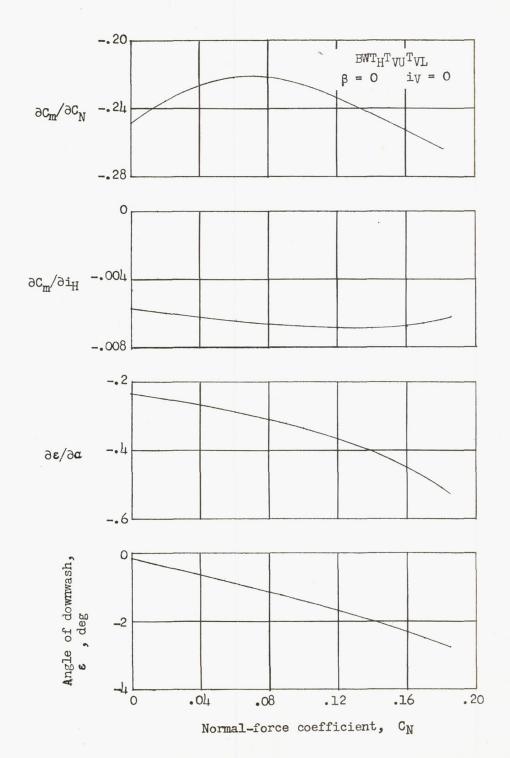
Figure 10.- Variation with normal-force coefficient of the downwash angle and the longitudinal stability parameters $\partial C_m / \partial C_N$, $\partial C_m / \partial i_H$, and $\partial \epsilon / \partial \alpha$ for model $BWT_H T_{VU} T_{VL}$ at trim conditions. $M = 4.06$; $R = 2.7 \times 10^6$.
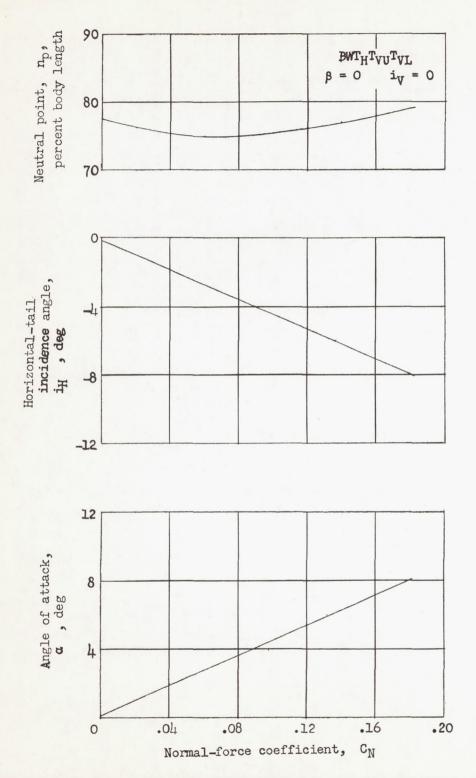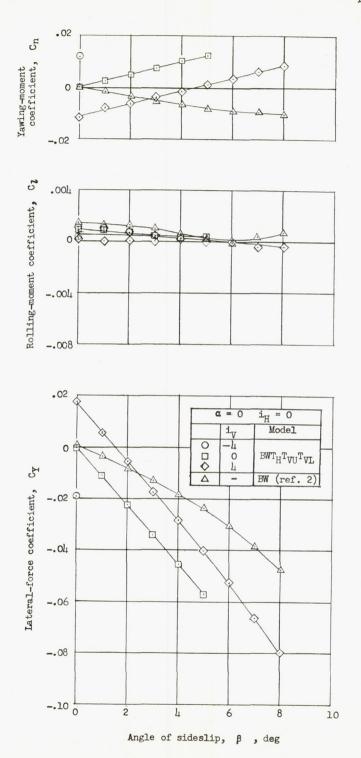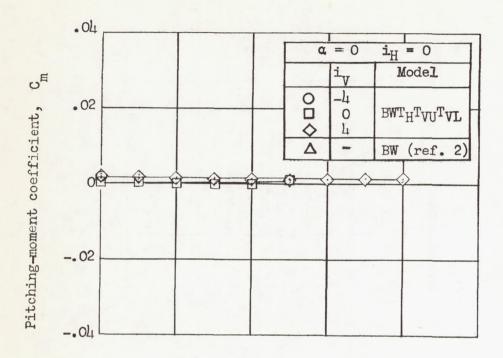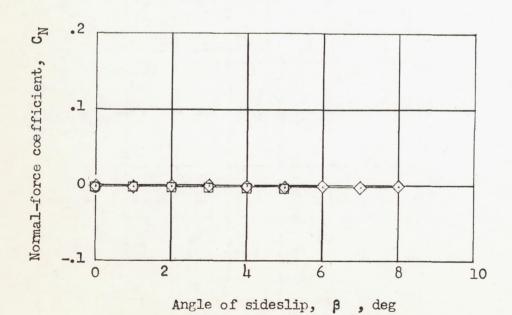
Figure 11.- Variation with normal-force coefficient of the neutral point, horizontal-tail incidence angle, and angle of attack for model $BWT_HT_{VU}T_{VL}$ at trim conditions. $M = 4.06$; $R = 2.7 \times 10^6$.

(a) Lateral characteristics.
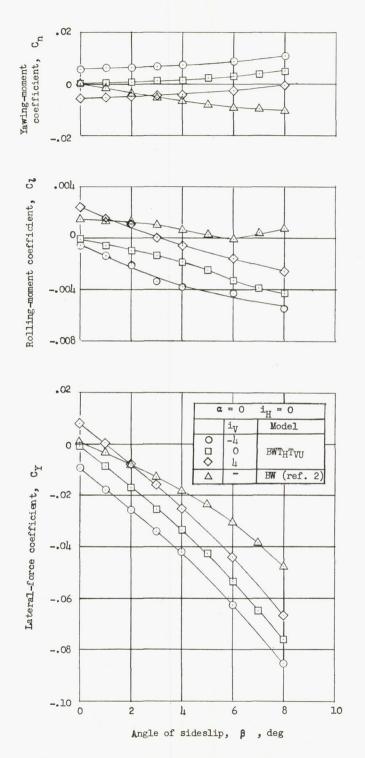
Figure 12.- Variation with sideslip angle of the lateral and longitudinal
    characteristics of model $BWT_HT_{VU}T_{VL}$ at various vertical-tail incidence
   angles.

(b) Longitudinal characteristics.
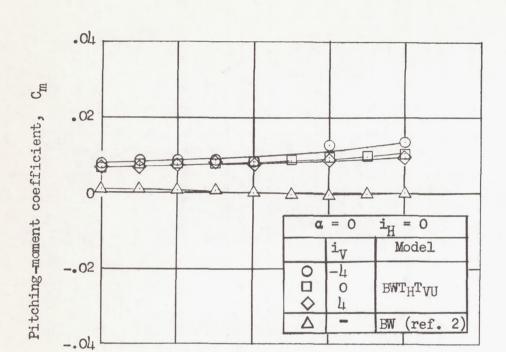
Figure 12.- Concluded.
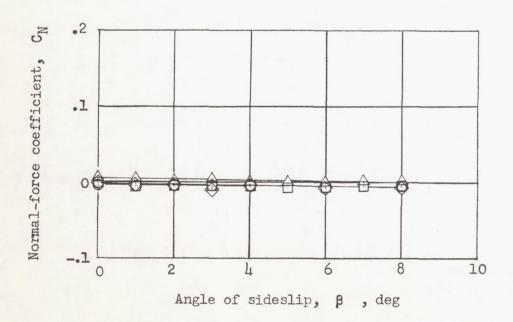
(a) Lateral characteristics.

Figure 13.- Variation with sideslip angle of the lateral and longitudinal characteristics of model BWT_HT_{VU} at various vertical-tail incidence angles.

4M
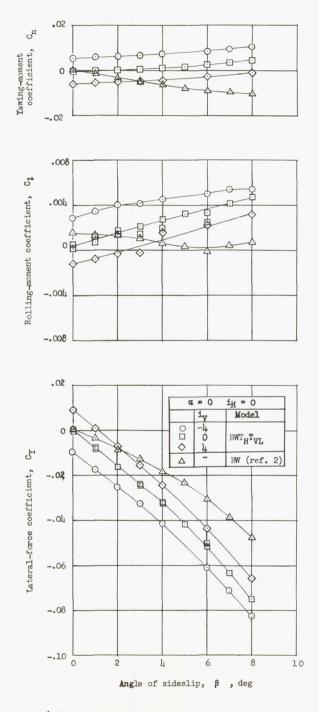
NACA RM L55B28
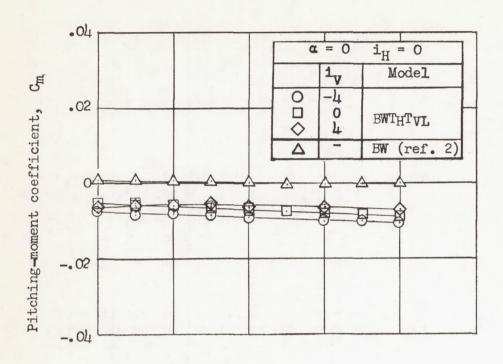
(b) Longitudinal characteristics.
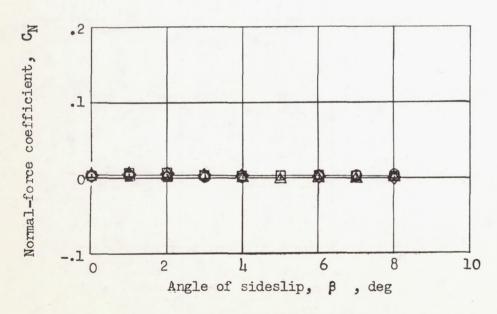
Figure 13.- Concluded.

(a) Lateral characteristics.

Figure 14.- Variation with sideslip angle of the lateral and longitudinal characteristics of model BWT_HT_{VL} at various vertical-tail incidence angles.

(b) Longitudinal characteristics.

Figure 14.- Concluded.
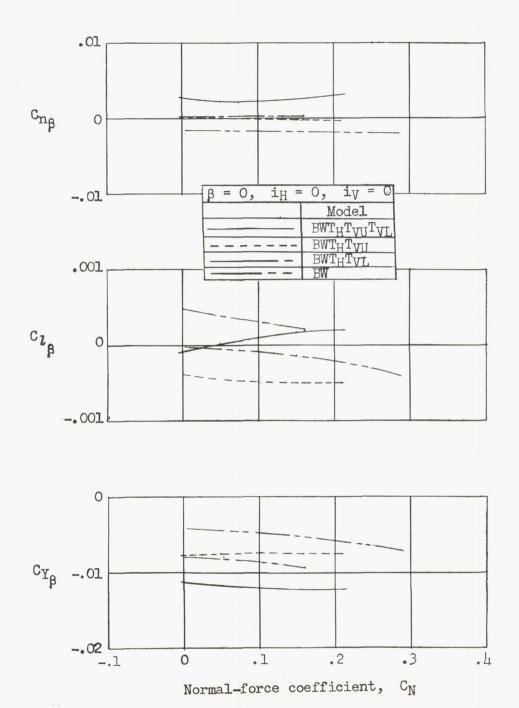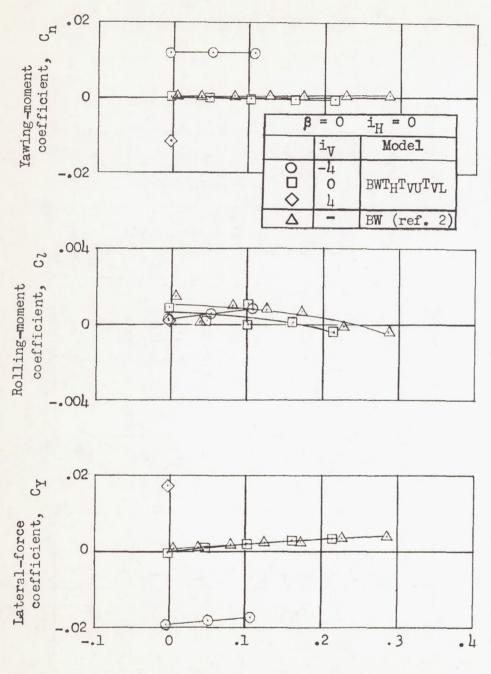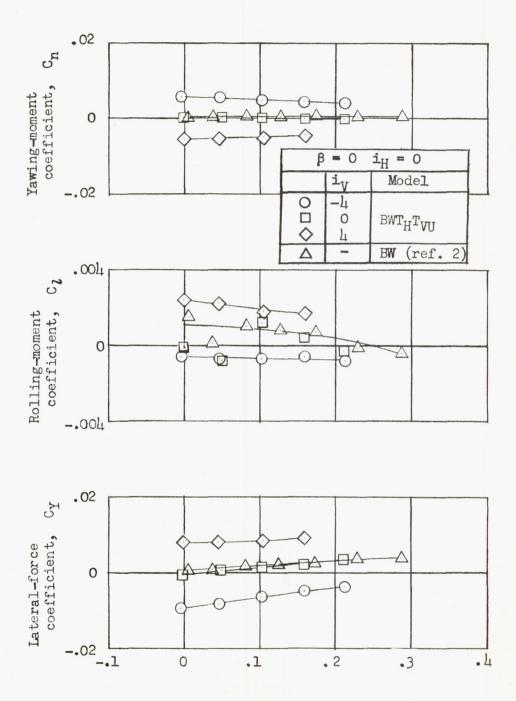
Figure 15.- Variation with normal-force coefficient of the lateral stability parameters C_{n_β}, C_{l_β}, and C_{Y_β} for models $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, BWT_HT_{VL}, and BW. M = 4.06; R = 2.7 × 10⁶.

(a) Model $BWT_HT_{VU}T_{VL}$.
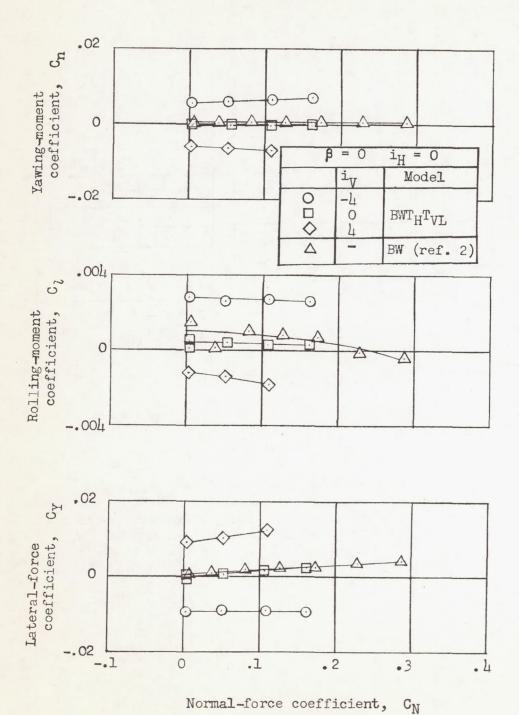
Figure 16.- Variation with normal-force coefficient of the lateral charac-
teristics of models $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, BWT_HT_{VL}, and BW at various
vertical-tail incidence angles. M = 4.04; R = 2.7 × 10⁶.

(b) Model $BWT_H T_{VU}$.

Figure 16.- Continued.

(c) Model BWT_HT_{VL}.
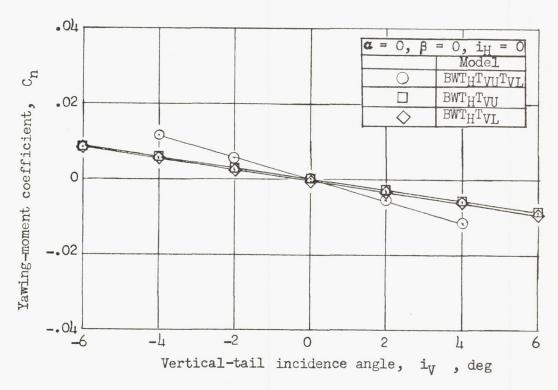
Figure 16.- Concluded.

Figure 17.- Variation of yawing-moment coefficient with vertical-tail incidence angle for models $BWT_HT_{VU}T_{VL}$, BWT_HT_{VU}, and BWT_HT_{VL}. $M = 4.06$; $R = 2.7 \times 10^6$.